

Remote Work and Satisfaction for Black Engineers and Computer Scientists

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Abstract—This Innovate Practice Full Paper discusses how many STEM professionals across all intersections have voiced the advantages of remote work. The preference of virtual work amongst professionals can vary for a lot of reasons such as being able to work and perform the role as a caretaker. COVID-19 has also proven that many professionals have been able to perform just as well if not better while working from home. Professionals have been able to have more autonomy over their daily lives to organize their work and space. As most are aware, during this health crisis there has been a heightened exposure of racism and other intolerances across the country and globally. Social media has also been a tool to expand people’s understanding of these injustices. For the Black community it has been a time to retreat, reclaim space, and take care of their selves, family, and communities through a variety of resistance tactics. Many have taken up to do the work to become (or becoming) allies. It is imperative to understand how remote work has been beneficial for Black professionals in engineering and computing fields as it relates to mitigating racism and any other forms of oppression. This could range from how virtual interviews worked to their advantage in landing positions to having their own space to work from without having to navigate micro and macro aggressions in-person. This paper will explore this phenomenon by gaining insight on the experiences of Black engineering and computing professionals in virtual settings through informal interviews and/or small focus groups. This study could potentially inform how remote work can be viewed as a tool for organizations to further support marginalized communities’ needs for obtaining safe spaces in engineering and computing hegemonic cultures; as well as further inform research on how organizations can implement safe spaces for marginalized people in their policies through entities like remote work.

Index Terms—DEI, Engineering Education, STEM Education

I. INTRODUCTION

While positive advancements around work-life balance have been achieved over the years, the current engineering and computing western work cultures still resemble the industrialization period in which they were established. Researchers call this the “Fordist” work model that was established by one

of the more widely known employers, Henry Ford, founder of the Ford Motor Company. Him and other industrial capitalists contributed to the complicated legacies of the work cultures established that were long, unsafe, unsanitary, anti-women, and anti-people of color [1]. In fact, many industrial employers held the belief that every “normal” man had the right to a living wage that would allow him to marry, support his family obligations, and earn enough for his own pursuit of happiness [1]. To no surprise, a “normal” man would be defined as a heterosexual, white male who had access to more work options and higher pay. This holds true in establishing engineering and computing jobs. It is important to contextualize that during the early industrial period, people of all backgrounds desperately desired to work. This created fierce competition and led to great hostility towards Black people who migrated from the South to escape terrorism from white Southerners [2]. To this day, the establishment of social hierarchies, racism, and sexism remain within the post-Fordist work culture.

Post-Fordist work culture is characterized by moving away from uncapped working hours, increased union presence and work benefits such as retirement plans and health-related insurance [1]. Post-Fordist allowed for employees to have more security at workplaces in exchange for exceptional work performance [3]. Nonetheless, researchers found that employees still have a lack of autonomy and heavy workload demands that have shown negative effects of employees’ emotional, mental, and physical well-being [3]. Author Vanroelen et al. (2009) focused primarily on the relationship between gender and age with respect to demand and stress levels. However, studies conclude that those with intersectional identities have even higher exposure to emotional, physical, and mental health concerns due to work environments that reproduce unhealthy work-life cultures [3].

Today, our global society has moved towards an increased use of technology and telecommuting with a peak being seen during the COVID-19 pandemic. Telecommuting originated in

the 1970s by Jack Niles, a government employee, who championed that telework helped with environmental justice initiatives such as cutting down on gasoline usage [4]. Telework has been a work culture movement that most western companies began to adopt in the early 2000s. However, researchers have reported that telework has not been made accessible for everyone. Though 40% of jobs across western countries have been proven to be telework capable, telework policies have been left to the discretion of managers to determine who will be able to take advantage of the service [4]. As a result, people with more education and higher employment status are more likely to receive the approval and support from their employers to work from home—which are primarily white men [4]. There is a need for more equitable practices of employers as it relates to telework for those that do not fall within the dominant majority.

In traditional work environments and in educational spaces, Black people have always had to consume harm from co-workers and managers who have displayed explicit or implicit racist behaviors in the form of micro/macro aggressions [5]. In many instances, Black people have had to alter their whole persona to navigate traditional, in-person workspaces in order to experience less workplace trauma [6]. Black students, especially in scientific and technical education, have also experienced this type of disturbance in their academic spaces from professors and other non-Black peers [20]. Historically, Black people (especially those who are descendants of slaves in America) have had a complicated relationship with work and work relationships with those who are of the dominant majority [21]. Engineering and computing spaces, especially, have been traditionally anti-Black [22]. It is for the interest of healing and improving this dynamic that researchers, practitioners, and policy makers look for creative ways to atone and mend the complex experiences Black people have had in pursuing education and careers in the STEM fields. With Black people trying to close the wealth gap in their communities, the pandemic has shown that telework has its strengths as people of lower socio-economic hierarchies have had more opportunity to access telework jobs; which ultimately increased their household incomes [23]. This is a positive step for oppressed groups who are actively trying to find ways to close the financial gap, as well as those who are determined to create affirmative and optimal work environments as opposed to the discriminatory spaces they may have been experienced in traditional, in-person workplaces.

II. LITERATURE REVIEW

The hope for this study is to illustrate telework becoming a potential diversity, equity, and inclusion tool for underserved students and professionals in engineering and computing spaces; this holds true especially for those who identify as Black and are continuously looking for parity and equity in engineering and computing spaces. In order to address this two-fold issue, existing literature surrounding the following was searched:

- 1) telework being utilized for DEI efforts

- 2) STEM students and professions experiences in telework posture.

Pre-COVID, telecommuting was seen as a progressive tool that organizations utilized for a variety of altruistic reasons such as offering flexible work environments to employees, supporting environmental movement, and inclusive virtual spaces to marginalized groups (Pereyra and Robin, 2021). Broadly, Pereyra and Robin (2021) gives a variety of ways that virtual work environments can build inclusive work cultures such as marginalized groups utilize the platform Slack and create channels where they can commune and bond with one another based on shared experiences/identities, managers can hold virtual office hours with a more relaxed feel (since people are in the comfort of their own homes), and increase the ability to attract and hire a more diverse workforce from communities who can benefit from working from home.

Collectively, Schur et al (2020), Bae et al (2019), Okeh (2021), Kinias (2022), Ford et al (2021) give different examples of how telework can further promote DEI initiatives for marginalized groups. Studies found that telework could be advantageous for those with disabilities as employers who take the time to understand their specific needs and how personal accommodations can be situated more easily in their homes; with more focus on performing their duties in a comfortable space [8]. Similarly, there is a correlation between having diverse management leadership such as women in decision making roles and closing the divide on telework access [9]. Generally, remote work has allowed for those of marginalized backgrounds to feel protected against harmful in-person encounters, feeling the need to alter oneself, the burden of long commutes, and more control over a work environment from a health standpoint as those with underlying health conditions do not have to worry about an office space that could further compromise their auto-immune systems [12]. Remote work can give students and professionals the ability to have more control over who they are and how others address them from simply being able to use the “rename” feature on platforms such as Zoom [10]. Likewise, researchers have learned that remote work for software developers that identify as transgender have felt a sense of relief in telework posture as they are able to complete their work almost all online with open-source software systems, engage/disengage on their own accord to protect their mental health when dealing with others who aren’t as sensitive to the on-going challenges this community faces, accessibility for higher paying jobs as economic disparities in this community is well documented, and identity disclosure at their own disclosure [11]. These articles give a discourse on how telework can serve as a DEI tool to an array of other groups. However, there is a gap in the literature on understanding how DEI can be used to people who share all or some of these mentioned intersecting identities in addition to being from the Black community. For example, there could be more literature that examines how telework could serve as a DEI tool to Black mothers, Black people who have pre-existing health concerns (especially with

all the knowledge surrounding health disparities in the Black community), Black trans people in professional spaces, Black disabled peoples, Black people who may have to commute far for their jobs, and etc. Most importantly, there has to be further analysis on how management/leadership give telework access to Black employers compared to others from non-marginalized backgrounds.

Though telework has had its set of challenges that should not be overlooked: scientists (including science students) not being able to have access to their labs, mental health issues from long periods of isolations, digital and technology divides, not having peer to peer interactions, most engineers and computing professionals and students have founded positive outcomes from telework; consequently, 8 out of 10 engineers want an hybrid option moving forward (Terminal, 2021); (Wright, 2020). From a diversity, equity, inclusion, and access position, Omar (2021), Nexstar (2022), Galvin (2020), Selco and Habbak (2021), Williams (n.d.), Baczech (2021) studies have shown telework as favorable amongst STEM students and professionals. For example, students earning higher education degrees have had more autonomy to work at their own pace and developed more effective study strategies from being able to have more independence in their studies. As a result, these students saw improvement in their test scores and their parents were more involved in their studies [15]. In smaller/more rural cities like Huntsville, Alabama, students and recruiters have found that virtual recruiting events have allowed students to have more access and attraction to STEM jobs that were not as publicized before the pandemic [16]. HBCUs have had the ability to use telework and virtual platforms in a way to serve their students and staff who need to do work from their home for health concerns and tell the history of civil unrest and systematic racism in a transparent way [17]. Moreover, HBCU leaders have come to terms that building robust online learning will allow for students (especially STEM students) to have more options to get their educational needs met [17]. Furthermore, STEM students at California State Polytechnic University reported that remote learning has given the ability to get more rest, taking control of stresses from coursework, increased productivity, self-care, and spending more time with loved ones [18]. Women STEM professionals have perceived remote work as an opportunity to gain more employment opportunities that used to be primarily centered in metropolitan cities, access to more virtual mentorship to support their career goals, as well as experiencing less gendered-base harassment [19]. The results from these studies have given a foundation on the perceptions and/or experiences of STEM students and professionals of virtual learning or work. However, there is a gap in surveying and analyzing Black STEM students' and professionals' views and experiences with telework. This is important to see if virtual work can potentially further close the racial divide for Black people in STEM.

III. METHODOLOGY

The specific research of interest for this paper is to investigate the preliminary perceptions and engagements that Black

engineering and computing professionals and/or students have around telecommuting. The results from this research would give more understanding on the outlook and desires Black STEM professionals and/or students have toward working remotely. In addition it will give researchers, practitioners, and policy makers more leverage in closing the gap in employee access to at least a hybrid option to better serve underserved populations in STEM fields. Essentially, this research can be made to understand how telework can allow underserved populations, in this instance the Black community, to lead healthy and whole lives as STEM professionals and students. In order to explore this nuanced issue, it was best to do a mixed-methods approach to looking at this topic as the researcher distributed the survey to those who identified as a Black STEM professional and/or student. To capture the voices of a breadth of STEM disciplines, those of social science and STEM education disciplines were considered as well. In order to further explore what was gained from the survey and to strengthen the research, an informal narrative was collected to capture the voice of a Black STEM professional (who is also a graduate student) on their experiences, attitudes, and beliefs on telework. The survey is a 10-question survey that was distributed over a 2-week period via Instagram (with many colleagues reposting), text messages, and emails. For the short amount of time given to complete this work, there were 62 respondents that participated. The informal interview was conducted on a participant who sits at many intersecting identities, Black, woman, masculine-lesbian, STEM professional, doctoral student, and has a learning disability. This narrative brings to life a story beyond the numbers that were captured from the survey and allows for the researcher to truly understand the impact that telework has on members of the Black community. The interviewee was familiar with the questions on the survey. The interview lasted an hour and a half as the researcher started off with similar, rudimentary questions that were listed on the survey, but allowed the interviewee to give as much detail within the subject of the research topic with limited interruption and follow-up questions only to gain clarity on what was shared. With the permission of the interviewee, the narrative was recorded for the entire duration. To draw attention to impactful words that were expressed during the interview, the researcher chose powerful quotes that came from the narrative.

Below are the items from the survey:

- 1) I identify as a Black, STEM student or professional (this includes social behavior and STEM education) professions
- 2) I was able to telework before COVID
- 3) I had to suppress my cultural/racial/ethnic identity in the workplace
- 4) If Q3 is yes, telework has made me feel less pressure to conform or suppress my cultural/racial/ethnic identity
- 5) Telework allowed me to enhance my work environment
- 6) Telework helped alleviate whatever negative, racial experiences I had faced in-person:

- 7) Telework helped me achieve work life balance
- 8) Telework allowed me to better take care of myself and my other responsibilities:
- 9) I know that I produce good work and showcase the same expertise in my respective field even in telework posture
- 10) I believe telework can be a tool that employers can use to better serve underrepresented employees

IV. RESULTS

In order to get fresh data in a quick turnaround, a 10-question Qualtrics survey was distributed through Instagram, text message, and email to Black professionals in the immediate network and some STEM professionals that are colleagues of other colleagues. Because of the short timeframe to collect data (approximately 2 weeks), the goal was 25-30 respondents. However, for this work in progress, the goal was surpassed and 62 respondents who identified as Black STEM professionals and/or students took the survey. *Figure 1* and *Table 1* give detailed breakdowns of survey results. A binomial test was conducted in order to compare the two possible outcomes of each survey question and calculate the p-values. Just a high level overview of the p-values indicate the significance of the statements presented to Black professionals and/or students who participated in the survey. To the researcher's surprise, 53% (33 participants) of the respondents were able to telework before COVID. However, 47% (29 respondents) still noted lack of access to telework before COVID. A large majority of participants (41 respondents) listed that they feel like they have to suppress the cultural/racial/ethnic identity in the workplace. Consequently, an overwhelming number of the participants (73.58%) noted "yes" to telework making them feel less pressure to conform or suppress cultural/racial/ethnic identity. Almost all the participants listed (55 participants) acknowledged that telework allowed for them to enhance their work environment. Results indicated that telework was beneficial in helping these Black STEM professionals alleviate whatever negative, racial experiences they had experienced in person. Similarly, 88.7% of the participants believed that telework helped them achieve work life balance. All participants except 3 noted that telework allowed them to better take care of themselves and all their other responsibilities. 96.77% of the respondents felt confident in their ability to produce good work in their respective STEM fields even in telework posture. Most importantly, 61/62 participants have the attitude that telework can be a tool that employees can use to better serve underrepresented employees. For the purpose of being able to check for reliability and correspondence of participants, the survey included emails for participants to list if there was a need to follow-up (while keeping their identities anonymous to the public).

V. EXCERPT FROM NARRATIVE

Elizabeth is a 29-year-old, Black, masculine, lesbian native and local to South Florida. She received her bachelor's degree in computer science and has worked as an instructional designer and has other interests in multimedia/computer software

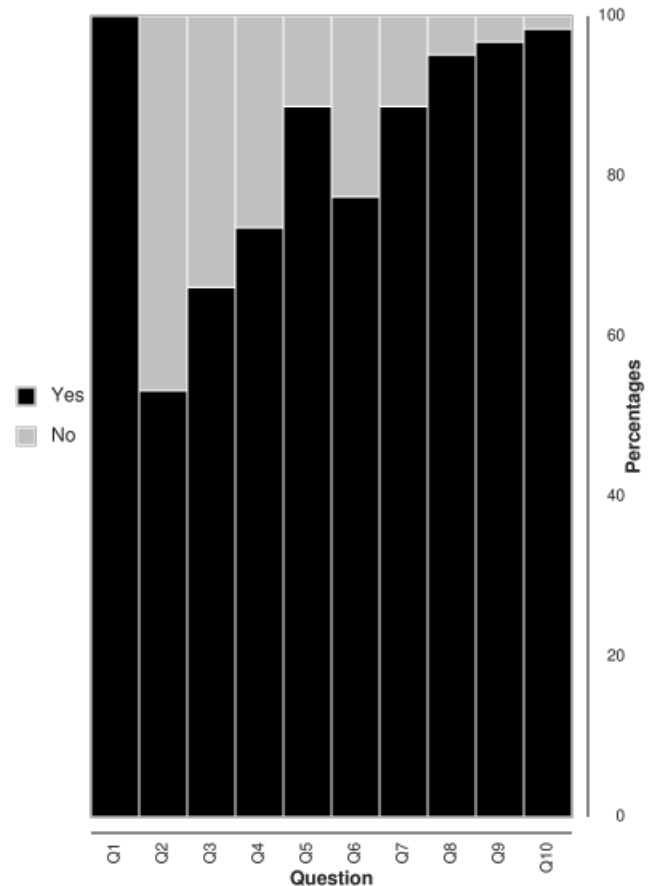


Fig. 1. Black STEM Profession and Students' Responses on Telework

development that she integrates into her career. While working her full-time position, she is a first-year engineering and computing education student who focuses on improving computer science pedagogy with assistant learning tools integrated into teaching practices.

Below is a snippet of of her interview with her thoughts surrounding telework:

"To be completely transparent, I am sure I am a highly functioning depressed person. A lot of what I do is because there is no other option. I have to go to work to make money to survive. I have to go to school to advance my career in my field to make more money to survive. Yes, I enjoy certain aspects of what I do, but it is just blah at some points. I am working with my therapist on many things, but it's been tough since I had to come back to campus to work. I blossomed in a remote environment. With no commute, I could wake up and meditate, take a daily 2-mile run, eat healthy home-cooked meals, and save a ton on commuter fees (gas, tolls, parking, etc.). I was the healthiest and the fittest I had ever been. I was able to lose 20 lbs. I am someone

TABLE I
BLACK STEM PROFESSION AND STUDENTS' RESPONSES ON TELEWORK

Question	Yes (1)	No (0)	Total	Minimum	Maximum	Mean	Standard Deviation	Variance	P-Value
1	62	0	62	1	1	1.000	<0.001	<0.001	<0.001
2	33	29	62	0	1	0.532	0.499	0.249	0.704
3	41	21	62	0	1	0.661	0.473	0.224	0.015
4	39	14	53	0	1	0.736	0.441	0.194	0.001
5	55	7	62	0	1	0.887	0.316	0.100	<0.001
6	48	14	62	0	1	0.774	0.418	0.175	<0.001
7	55	7	62	0	1	0.887	0.316	0.100	<0.001
8	59	3	62	0	1	0.952	0.215	0.046	<0.001
9	60	2	62	0	1	0.968	0.177	0.031	<0.001
10	61	1	62	0	1	0.984	0.126	0.016	<0.001

who has always been an introvert. I have never felt like I was part of a community. As a masculine-presenting Black queer woman, I have always faced discrimination. It's part of the game of life, I guess. With us transitioning back into the office, I have had to prepare myself to deal with the microaggressions and loss of autonomy in my workspace. I noticed that the healthy routines that I have developed during telework posture for myself are slowly diminishing and hard to keep up with. I truly believe that a hybrid position would make a world of difference for me to establish myself, wholly. With the type of position I have, there is no reason for me to have to be in the office every day. I know for a fact that the concept of managing bodies in a chair takes precedence over understanding what each employee needs to be their best self in their position. Unfortunately, Black people in the workplace will be the last to get this sort of consideration—especially one that sits at all the intersections that I have as a part of my identity.”

When analyzing Elizabeth's narrative and comparing it with the results of the Qualtrics survey, her response is in line with the results given from the survey. Elizabeth fits the category of both a STEM professional and student as she has her bachelor's degree in computer science, works as an instructional designer to support online degree programs, and is getting her doctorate in computing education. Similar to other respondents, telework allowed her to enhance her work environment tremendously as working from home shields her away from the racialized and gendered trauma that she experienced pre-telework. Though she vocalized that she has not diminished her identity in its entirety, she has had difficulty with people denoting her womanhood by addressing her with the wrong pronouns because she does not shy away from being a masculine presenting lesbian. Elizabeth's narrative is especially important when analyzing her response to questions 7 and 8 because being forced to go back to work after being able to work from home for two years took away the autonomy that enabled her to lead a life that allows her to put her well-being as a priority. While already struggling with mental health challenges and some learning disabilities, she mentions that having to adjust with going into the office and the troubles that come with it are overwhelming. She strongly believes

that telework can be a tool that organizations can use in:

- acknowledging that Black and underserved groups have historically had to mitigate toxic work cultures and
- give this work option as a resource in supporting these groups in having more pleasurable work experiences—especially in STEM fields.

VI. DISCUSSION OF RESULTS

Remote work was established in support of mitigating societal issues such as environmental pollution, limiting gas usage, cutting down on commuting, work-life balance, etc. We are in a time where these issues have not gone away—if anything—those same issues have manifested themselves even more. We are living in a world where climate challenges are at an all-time high, war is devastating oppressed communities and economies, gas prices have skyrocketed, and people are struggling with work-life balance and mental health challenges [25, 26, 27]. For engineering and computing positions that can be fully remote, there is no rationale for employers to not support the requests of employees who are needing this option to help facilitate a healthy work-life balance. During the endless media coverage of Black lives being taken away from systemic police encounters, many companies were swift with putting out their support for Black Lives Matter. For example, tech companies such as Microsoft stated, “...we believe that Microsoft can put the power of data, technology, and partnership to work to help improve the lives of Black and African American citizens across our country” [28]. The blog post went on to list four initiatives in support of enhancing the lives of Black lives such as creating technology that will promote racial equity and create safer systems for Black people's encounters with law enforcement, supporting the development of digital skills in Black youth and adults, increasing technology access to Black communities and business, and etc. [28]. Though these initiatives are promising and needed, organizations have to consider unique ways in which they can support their Black employees holistically. The CEO of Microsoft has made statements limiting telework and moving employees back in-person though his own companies' research shows favor in telework [29]. If leaders of organizations like Microsoft want to support Black lives' movements, it is imperative for them to look at opportunities like remote work in a way that enriches the socio-cultural dynamic for underserved populations who have

faced unfavorable in-person work conditions before taking away these tools. Many of the Black participants of this study have shown that they value and need telework so that they can succeed in their positions. Most of the participants have indicated that they are still able to maintain a high level of performance in telework posture, telework has helped them mitigate racism in the workplace, and remote work can be a tool for employers to serve underserved employees. It is crucial for employers to listen to the voices of their Black employees (and other underserved groups) when making DEI policies in the workplace in order to be inclusive not just in numbers but changing the cultural dynamic by taking heed to the voices of the marginalized so they can lead and influence positive changes in the workplace. Sound leadership should take into account what is going to allow Black engineers and computer scientists to flourish not in just their technical skills, but also in what will support their overall being in these positions as we are continuously fighting for social justice in all spaces.

VII. FUTURE WORK

Though this work in progress paper gives a preliminary foundation in understanding the history of telework, inequities in access to telework, the positive outcomes that have come from telework, and a basis of some Black engineers and computer scientists' experiences and thoughts on telework, there were limitations with the study that future research can address. This work can be furthered by:

- extending and expanding the deadline on collecting data
- giving participants in the survey the ability to write out their experiences with telework in greater detail
- diving deeper into the intersecting identities of Black participants to see how their experiences and attitudes with telework compare and contrast

This work could also become the basis for researchers to look at how policies around telework have either favored or not favored Black employees' abilities to telework. The goal was to gain an understanding of telework giving way to more satisfying work-life experiences for those who identify as Black STEM professionals and students. Black engineers and computer scientists are just as deserving to live and lead whole and healthy lives. Telework has been proven to be a factor that can support this.

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